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(54) **Arrangement of separating devices.**

(57) The invention provides an arrangement of at least two separating devices (2,16) for separating into elements or groups of elements planos (26) having at least two weakening lines (27,28) which are oriented at an angle to one another and partly bound the elements (26), which devices (2,16) each comprise:

a first clamping member (4) for fixedly clamping on a side of a first weakening line (27) a plano (26) or stack of planos (25), in this latter case such that the relevant corresponding weakening lines (27) of the stack (25) lie in a plane extending perpendicularly of the main plane of a plano (26);

a second clamping member (5) for fixedly clamping the plano (26) on the other side of this weakening line (27); and

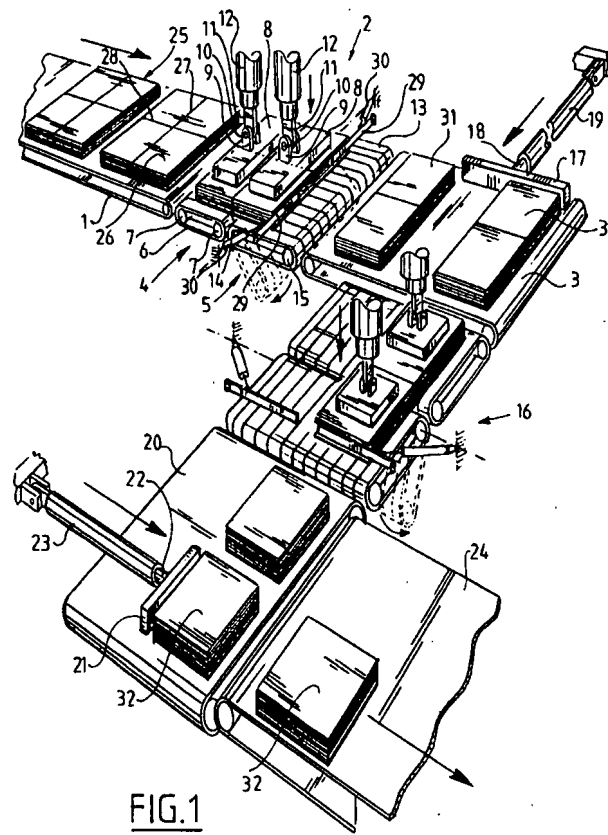
tilting means for mutual tilting of the first clamp-

ing member (4) and the second clamping member (5) such that the plano (26) or stack of planos (25) are separated into two elements or groups of elements (31) by breaking the said weakening line (27);

which arrangement further comprises transporting means (1,3,6,13,17) defining a transport path which,

- feeds the planos (26) into a first separating device (2) and discharges said planos therefrom in a direction perpendicular to the said first weakening line (27),
- alters the transporting direction such that this extends in a direction perpendicular to the second weakening line (28), and
- feeds the planos (26) into the second separating device (16) in this direction.

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Known from EP-A-0 292 067 is a separating device which is equipped for separating pianos provided with at least one weakening line into elements or groups of elements.

The invention has for its object to provide an arrangement making it possible, with use of two or more such known separating devices, to ensure a great flexibility, handling speed and continuity.

In order to realize this objective the invention provides an arrangement of at least two separating devices for separating into elements or groups of elements pianos having at least two weakening lines which are oriented at an angle to one another and partly bound the elements, which devices each comprise:

a first clamping member for fixedly clamping on one side of a first weakening line a piano or stack of pianos, in this latter case such that the relevant corresponding weakening lines of the stack lie in a plane extending perpendicularly of the main plane of a piano;

a second clamping member for fixedly clamping the piano on the other side of this weakening line; and

tilting means for mutual tilting of the first clamping member and the second clamping member such that the piano or stack of pianos is separated into two elements or groups of elements by breaking the said weakening line;

which arrangement further comprises transporting means defining a transport path which,

- feeds the pianos into a first separating device and discharges said pianos therefrom in a direction perpendicular to the said first weakening line,
- alters the transporting direction such that this extends in a direction perpendicular to the second weakening line, and
- feeds the pianos into the second separating device in this direction.

The invention relates more particularly, but not exclusively, to such an arrangement with at least three separating devices and transporting means embodied such that at least two transport paths are defined thereby which each comprise at least one separating device, which at least two transport paths have a common portion comprising at least one separating device, wherein at the location of the transition from the common portion to the individual portions means are present for transporting the pianos alternately over the respective transport paths.

Due to the fork-shaped structure, such an arrangement makes it possible to split one transport path into two or more transport paths or to merge two or more transport paths into one transport path.

In the common portion the separating device can for instance have a greater width or be

equipped for a greater handling speed; the separating devices in the individual portions can be relatively small or have a slower handling speed.

The invention thus offers the possibility of allowing two punching machines for the pianos to be followed by one further handling line.

The function of the separating devices and the transport means can be controlled from a central control unit, if desired making use of means for detecting for example the length and width of the pianos or stacks of pianos for handling. Fully automatic operation can thus be put into effect. This means that it is possible to transport different sizes of pianos or stacks of pianos through one and the same separating device in one handling operation. The central control unit determines the setting of the separating devices on the basis of the signals generated by the detecting means.

Inserting pianos or stacks of pianos from two punching machines into the arrangement can result in a significant cost reduction compared to a known arrangement in accordance with EP-A-0 292 067.

The invention will now be elucidated with reference to the annexed drawing, in which:

figure 1 shows a schematic perspective view of a first arrangement according to the invention;

figure 2 shows a separating device wherein the dividing plane extends in the transporting direction;

figure 3 shows a perspective view of another separating device;

figures 4, 5 and 6 show schematic side views of the device according to figure 3 in successive phases of a separating cycle; and

figures 7, 8, 9 and 10 show four different arrangements according to the invention.

The device depicted in figure 1 comprises a feed conveyor 1, a separating device 2 and a discharge conveyor 3. The separating device 2 is formed by a first clamping member 4 and a second clamping member 5.

The first clamping member 4 comprises a short conveyor 6 which is trained about two belt rollers 7. Arranged under the upper half of conveyor 6 is a support, not shown in the drawing, for absorbing the clamping forces. Arranged above the conveyor is a pressure plate 8 which is fixed by means of a bracket 9 and a shaft 10 to a rod 11. The rod 11 is movable in vertical direction by means of a hydraulic cylinder 12.

The second clamping member 5 is likewise formed by a conveyor 13 which is wound around a first belt roller 14 and a second belt roller 15. The shaft of the belt roller 14 is arranged fixedly so that the belt roller 14 can only rotate while the shaft of belt roller 15, like the conveyor 13, can move arcuately downward to a lower position as indicated by dashed lines. It is also possible to cause the

assembly formed by the rollers 14 and 15 to rotate around another centre line extending parallel to the axis of roller 14.

Also arranged under the upper half of conveyor 13 is a plate, not shown in the drawing, which can likewise take part in the downward oriented tilting movement of the belt 13 and the movable belt roller 15.

Arranged once again above the belt 13 is a pressure plate 8 which is fixed by means of a bracket 9 and a shaft 10 to a rod 11 so that the pressure plate can tilt relative to the rod 11, while the shaft 10 is likewise movable in vertical direction by means of a hydraulic cylinder 12. It is also possible to design the whole press-on device 8, 9, 10 and 11 such that it is tiltable about the same axis as the assembly of the two rollers 14, 15.

Arranged above the belt 13 are two movable stops 29 which can be moved upward by means of hydraulic cylinders 30.

Adjacent to the conveyor 3 is arranged a second separating device 16, the construction of which corresponds with the above described separating device 2. However, the dividing plane of this second separating device 16 extends perpendicular to the direction of the dividing plane of the first separating device. By connecting these two separating devices 2, 16 one after the other it is possible to separate the elements for separation from each other in two directions extending mutually perpendicularly.

A pusher member 17 is arranged to transport the elements for separating from the conveyor 3 to the second separating device 16. This pusher member 17 is connected to a hydraulic cylinder 19 by means of a rod 18 so that the pusher member can move in the direction extending perpendicularly of the direction of movement of conveyor 3. Instead of a conveyor a system of belts or chains can also be used.

Arranged following the second separating device 16 is a second discharge conveyor 20, above which a pusher member 21 is once again arranged which is connected to a hydraulic cylinder 23 by means of a rod 22 so that the pusher member 21 is movable in the direction extending perpendicularly of the conveying direction of the belt 20. Arranged adjacent to this belt 20 is a discharge conveyor 24.

The operation of the combined separating device will now be discussed. Supplied on the conveyor 1 are sheets of cardboard which are each formed by four planos 26. The planos 26 are mutually separated by two dividing lines 27, 28 extending perpendicularly of one another. The movement of the conveyor is controlled such that the stacks of cardboard 25 are carried one by one towards the separating device 2. The conveyors 6

and 13 are herein likewise driven. The movement of the stack of cardboard sheets is continued until this comes up against movable stops 29.

The pressure plates 9 are then moved downward by means of the hydraulic cylinders 12 until they clamp the relevant planos fixedly against the respective conveyors 6 and 13 and the supports placed thereunder. The same result can be achieved by pressing up the planos by means of a pressing member between the belts 6, 13 against a fixed but adjustable pressure plate.

The stops 29 are then moved away by means of hydraulic cylinders 30 and the second clamping member performs a tilting movement about the tilt axis. During this tilting movement the conveyor 6, the support, the conveyor 13 and the roller 15 rotate around the axis of the roller 14 or downward around the tilt axis arranged elsewhere. Since the pressure plate 8 is in any case rotatable about the shaft 10 and since the pressure from above remains applied, it will take part in this turning movement so that the planos clamped in between the second pressure plate 8 and the conveyor 13 will also take part in this movement and the two stacks of planos are separated along the break line. When this tilting movement is completed it is carried out again in reverse direction.

The conveyors 6 and 13 are herein controlled such that the stacks of planos attached in pairs move one by one onto the conveyor 3.

These stacks 31 of planos attached in pairs are there transported one by one by the pusher member 19 to the second separating device 6 and again subjected to a separating operation. Resulting from the processing in this second separating device are separate stacks of planos 32 which pass onto the conveyor 20 and are there pushed by the pusher member 21 one by one to the discharge conveyor 24. The cardboard sheets are thus separated into thick stacks in two directions without human intervention.

In the embodiment shown in figure 2 the separating device 33 consists of two conveyors 34, 35 separated in lengthwise direction. The conveyor 34 is trained about two belt rollers 36, 37, while the conveyor 35 is trained about two belt rollers 38 and 39. The belt rollers 36 and 38 are mutually connected by means of a flexible coupling 40, as are the belt rollers 37 and 39. Further arranged beneath each of the belts 34, 35 is a support 41, 42. Arranged once again above the upper half of the conveyor 34, 35 is a pressure plate 42 which is connected to a hydraulic cylinder 46 by means of brackets 43, a shaft 44 and a rod 45.

The operation of this second embodiment of the present invention is the same as that of the embodiment shown in figure 1, except that the conveyors are tiltable in their lengthwise direction.

This has the advantage that this device can be placed immediately behind the first separating device of figure 1 so that no change of transporting direction is necessary for separation in the second device. Both separating devices 2, 16 can also be placed one after the other, wherein however a rotary table must be interposed. Further shown in figure 2 is that both conveyors are downward tiltable. It is also conceivable that only one of the conveyors is downward tiltable.

Using this device it is also possible to mutually separate the stacks of pianos without human intervention.

The above described embodiments relate to the separation of stacks of pianos. The device according to the present invention can likewise be used for separating other separable objects.

Use is made in the above described embodiments of hydraulic cylinders 12 for causing the movement of the pressure plates. It is also possible to make use of pneumatic cylinders, electro-motors or hand wheels.

Other transporting means may also be employed instead of the pusher member used in the above embodiments.

Using the device according to the present invention it is also possible to separate elements which are each partly separable in a plurality of parallel planes, for instance when two elements are mutually connected by a crenellated dividing line and the connections for separating are only present on the end faces.

Such elements can also be separated stepwise, that is, successively plane by plane.

When the device intended for two mutually perpendicular separating planes is used for only one separating plane, one separating device can be switched off and used as transporting device.

The principle according to the invention can also be implemented by only one separating device in combination with buffer and transporting means, which carry a stack of objects already processed once through the separating device for a second time such that separation along the other transversely positioned weakening line(s) takes place.

Figure 3 shows a separating device 101 in perspective view. Anticipating the discussion of figure 4, figure 5 and figure 6 it is pointed out here that the feed into the device 101 of stacks of pianos 102 takes place by making use of transporting belts 103. During the separating operation the stacks of pianos 102 are supported by up and downward movable support beams 104 extending therebetween.

Figure 4 shows the device 101 in side view with the cover 105 removed.

The stack of pianos 102 is fed into the device

101 by the transporting belts 103 and a set of transporting belts 106 connecting thereto which co-act with a second set of support beams 107.

The device comprises an in-feed frame 108 and a discharge frame 109. The in-feed frame 108 is fixedly arranged in the transporting direction and comprises the transporting belts 103 and the support beams 104 which are up and downward movable by means of hydraulic cylinders 110 for pressing an inserted stack 102 against a support 111 situated above. In corresponding manner the discharge frame 109 comprises hydraulic cylinders 112, using which the support beams 107 are movable upward for pressing the stack 102 against a support 113. The discharge frame 109 is pivotable about a pivot shaft 114 relative to the in-feed frame 108 such that the discharge frame 109 is tiltable under the influence of a hydraulic cylinder 115. This tilting is controlled from control means (not drawn), as is the operation of the other active components of the device 101.

It is noted that drive means for the transporting belts 103, 106 are not shown. These are also driven from a central control unit.

In the device shown in figure 4 the stack 102 is fed into the device 101 according to arrow 116 such that the weakening lines present in the stack of pianos 102 all lie in one vertical plane corresponding with the position of the pivot shaft 114.

Figure 5 shows the subsequent situation in which the support beams 104, 107 are carried upward by actuation of the hydraulic cylinders 110, 112, whereby they clamp the stack of pianos 102 against the supports 111, 113.

Figure 6 shows the following phase wherein in this clamped situation the discharge frame 109 is tilted relative to the in-feed frame 108 by actuating the hydraulic cylinder 115. As a result of the thus exerted force the stack is divided into two parts along the central plane with the weakening lines of the pianos.

After reaching this situation the device is returned to the situation as in figure 5, wherein however the two stacks 117, 118 are mutually separated, then returned to the situation shown in figure 4, whereafter by driving of the transporting belts 103, 106 the two stacks 117, 118 can finally be removed from the device 101 either pressed against one another or with intermediate spacing.

Figure 7 shows the feed into a device 101 of stacks of pianos 119 with one transverse weakening line 120 and two longitudinal weakening lines 121. The device 101 separates the stacks 119 into part stacks 122, each with two longitudinal weakening lines. By means of rotation means (not drawn) the stacks 122 are turned through 90° relative to the conveying direction 116, as designated with arrows 123, and carried with this new orientation

into a following device 124 which can be functionally identical to the device 101 but can take a narrower form. This device 124 divides the part stacks 122 into separate stacks of elements 129.

Figure 8 shows a configuration in which, by means of pusher members (not drawn) functionally identical to the pusher members 17, 18, 19 of figure 1, the part stacks 122 are displaced alternately to the left, the direction 125, and to the right, the direction 126, for feed into separating devices 127, 128 corresponding with device 124 where they are processed in the manner as indicated in figure 7 with reference to the device 124. By means of rotation means (not shown) each stack of elements 129 is carried away in sideways direction according to arrows 130, 131 after leaving the device 127, 128.

Figure 9 shows another arrangement according to the invention which will be dealt with more briefly after the foregoing comprehensive discussion of figure 8. The arrangement shown in figure 9 has two confluent transport paths designated 132 and 133. Other than in the embodiment according to figure 8 it is the case that not one transport path is divided into two transport paths but that two transport paths are merged into one transport path. After the description above, figure 9 requires no further elucidation.

The arrangement of figure 10 differs from the arrangement of figure 9 insofar as a transport path 134, in contrast to the transport path 133 according to figure 9, has two separating devices 128, 135, whereby supplied planos 136 with three transverse weakening lines 137 are first divided into two and, after being transported in transverse direction, are subsequently fed into the device 128 such that they are separated once again along the other weakening lines.

Attention is drawn to the fact that use can be made of only one separating device in combination with transporting means for twice feeding planos therethrough, for dividing the planos into part planos respectively along the weakening lines in the one and the other direction.

## Claims

1. An arrangement of at least two separating devices for separating into elements or groups of elements planos having at least two weakening lines which are oriented at an angle to one another and partly bound the elements, which devices each comprise:

a first clamping member for fixedly clamping on a side of a first weakening line a plano or stack of planos, in this latter case such that the relevant corresponding weakening lines of the stack lie in a plane extending perpendicu-

larly of the main plane of a plano;

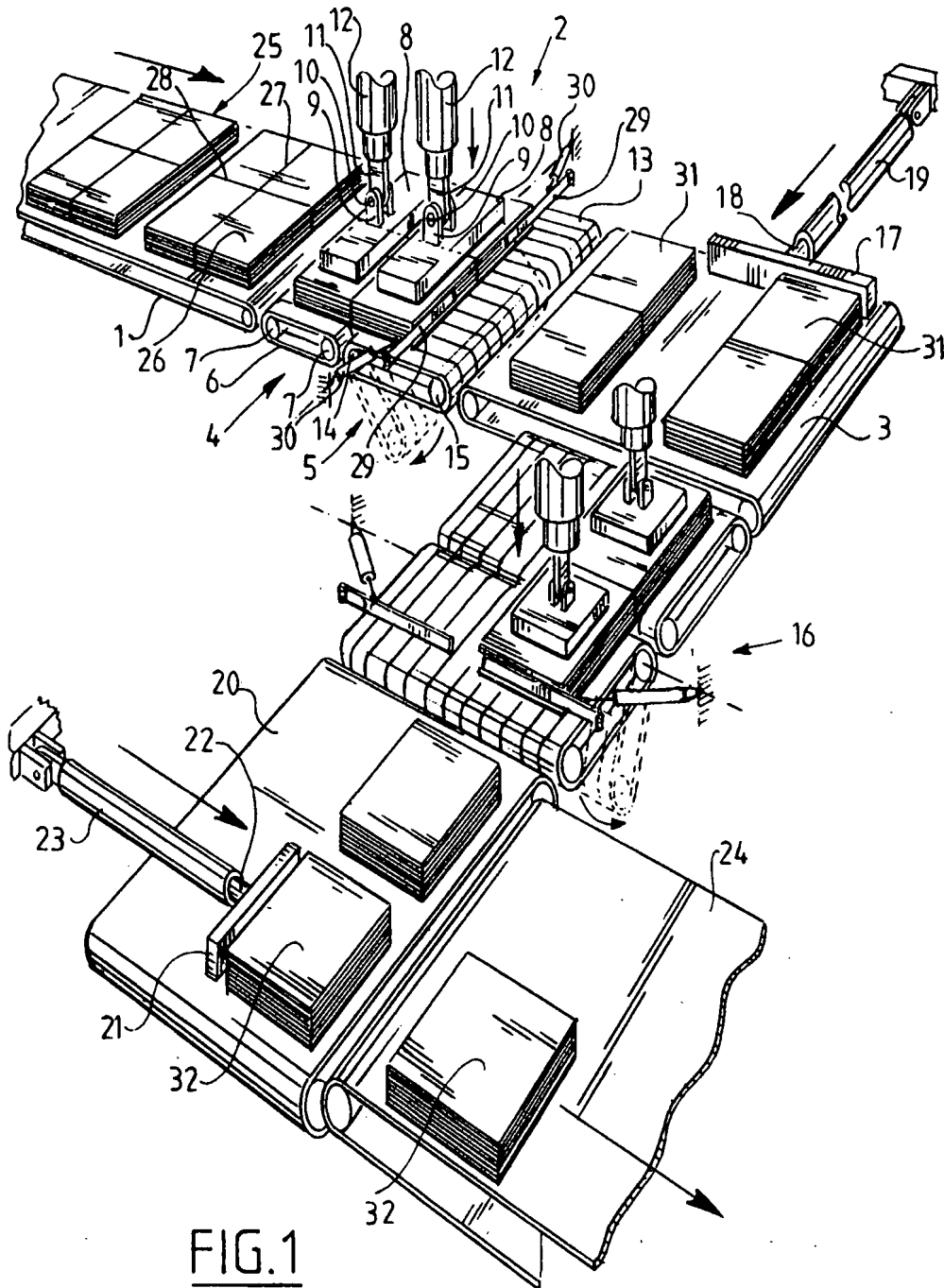
a second clamping member for fixedly clamping the plano on the other side of this weakening line; and

tilting means for mutual tilting of the first clamping member and the second clamping member such that the plano or stack of planos are separated into two elements or groups of elements by breaking the said weakening line;

which arrangement further comprises transporting means defining a transport path which,

- feeds the planos into a first separating device and discharges said planos therefrom in a direction perpendicular to the said first weakening line,
- alters the transporting direction such that this extends in a direction perpendicular to the second weakening line, and
- feeds the planos into the second separating device in this direction.

2. An arrangement as claimed in claim 1, with at least three separating devices and transporting means embodied such that at least two transport paths are defined thereby which each comprise at least one separating device, which at least two transport paths have a common portion comprising at least one separating device, wherein at the location of the transition from the common portion to the individual portions means are present for transporting the planos alternately over the respective transport paths.
3. An arrangement as claimed in claim 1, comprising one separating device and transporting means for twice feeding planos therethrough, for dividing the planos into part planos along the respective weakening lines in the one direction and the other direction. It will be apparent that with such an arrangement economic advantage can be achieved in particular conditions.



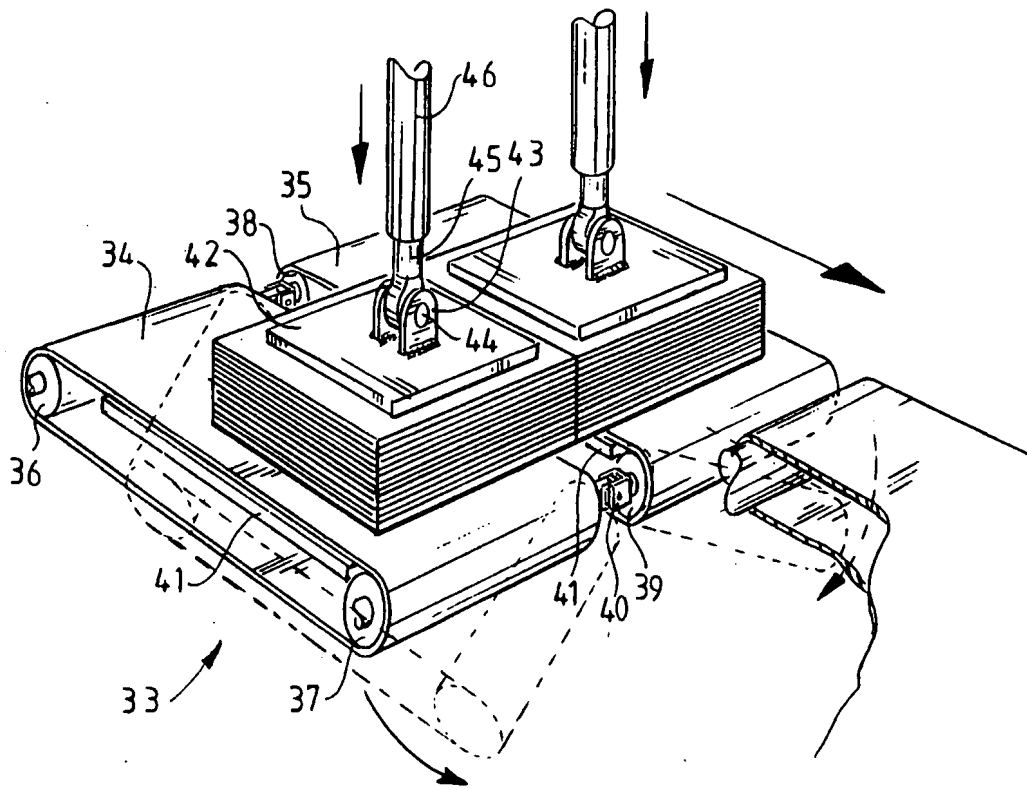


FIG. 2



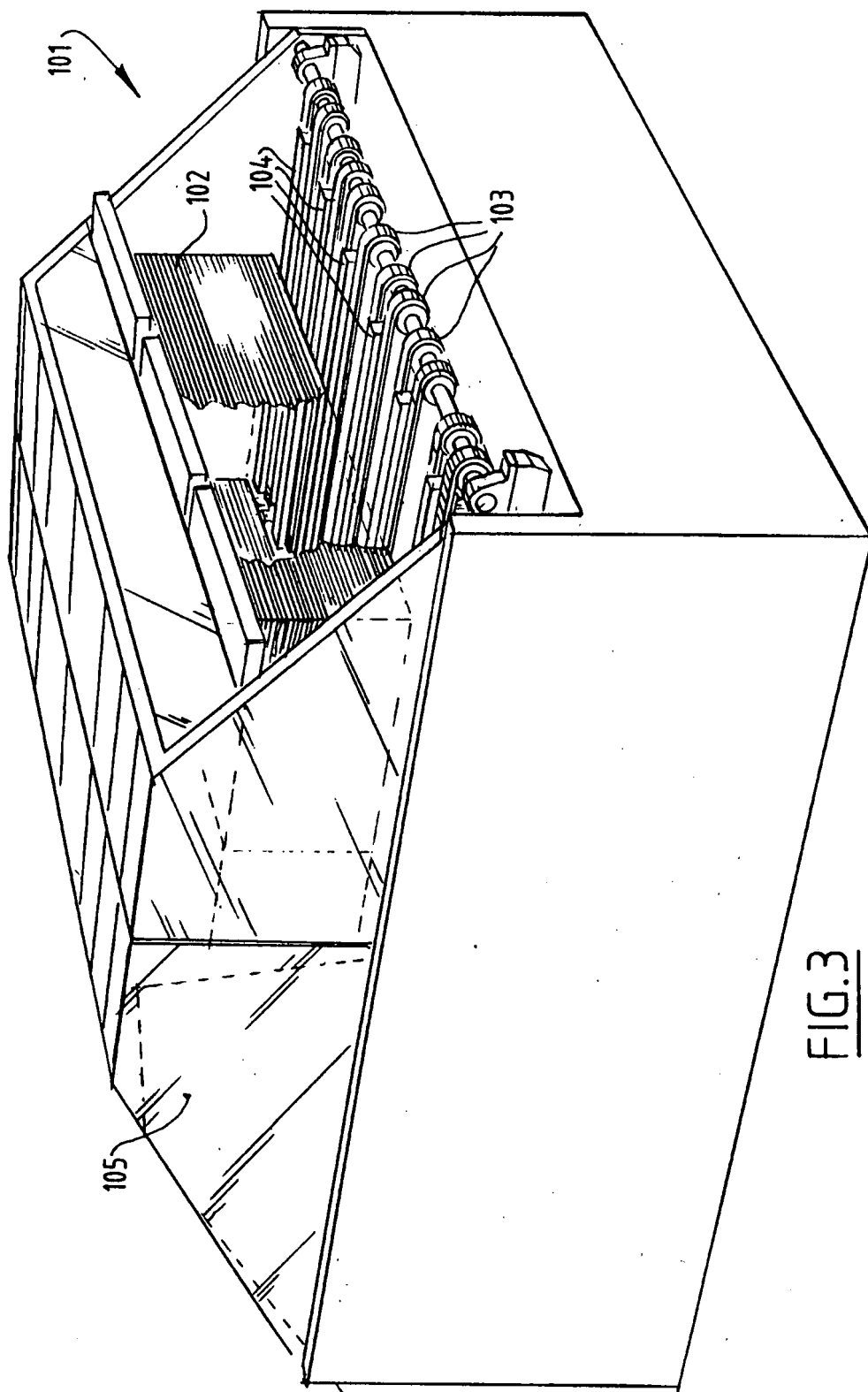
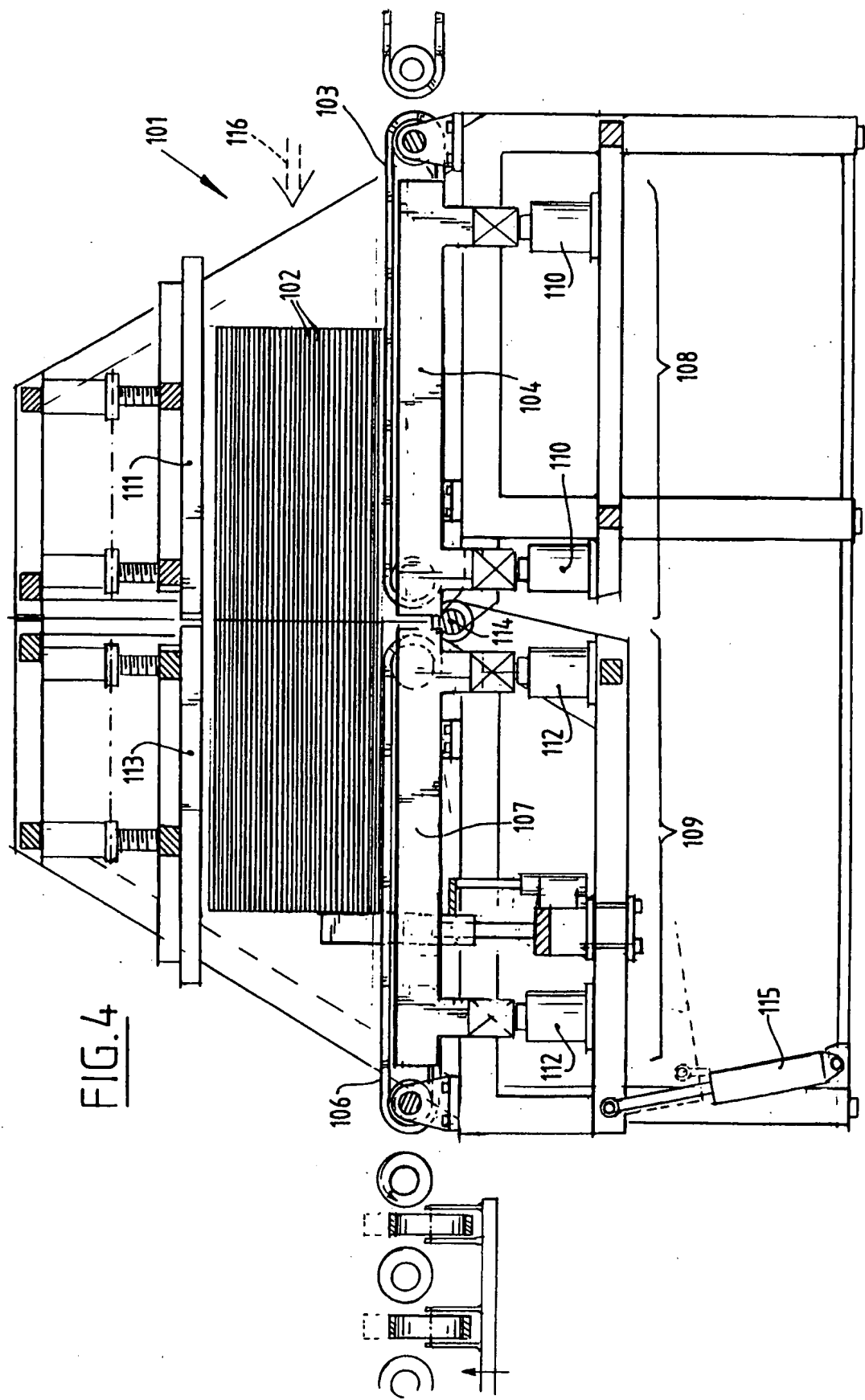
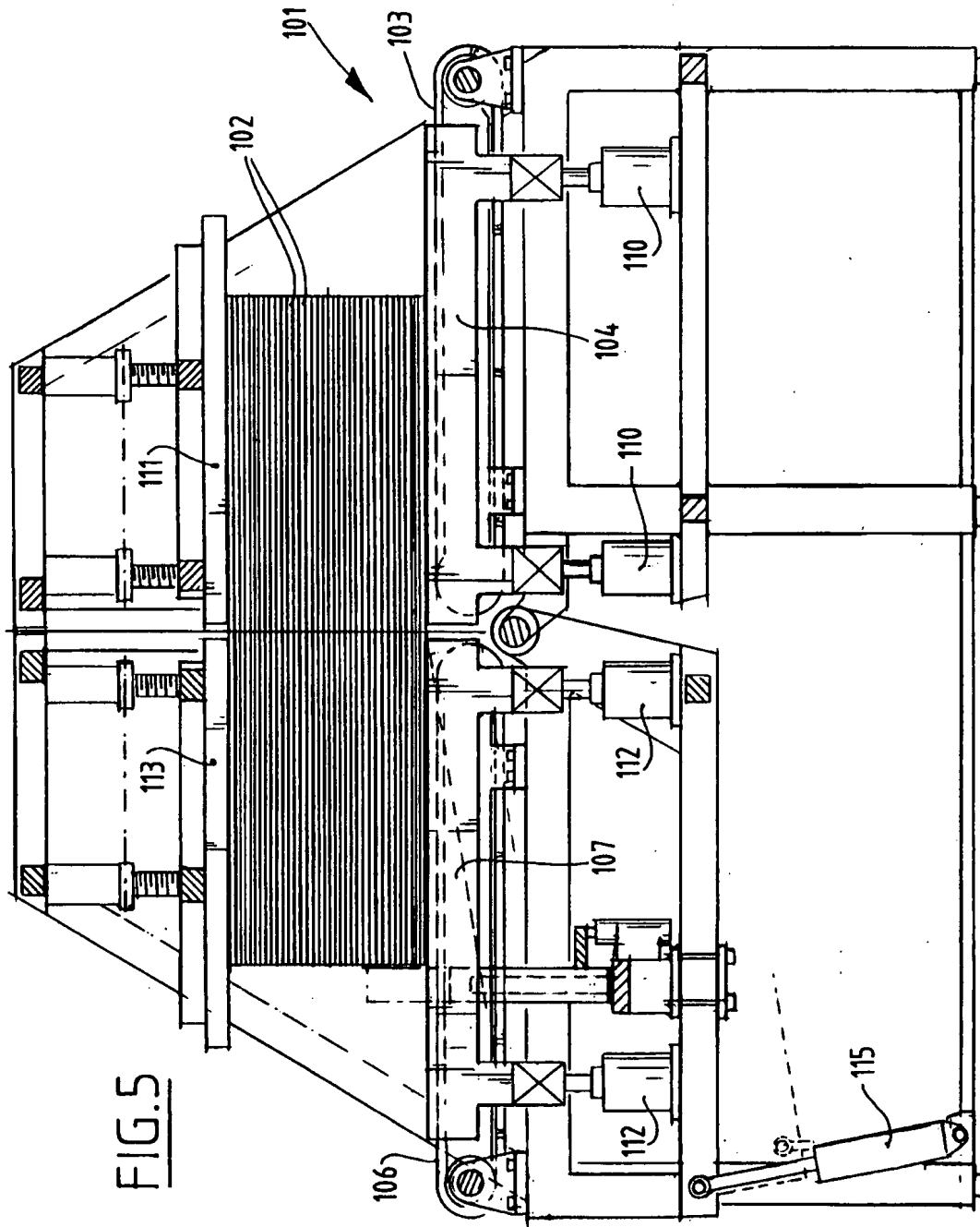
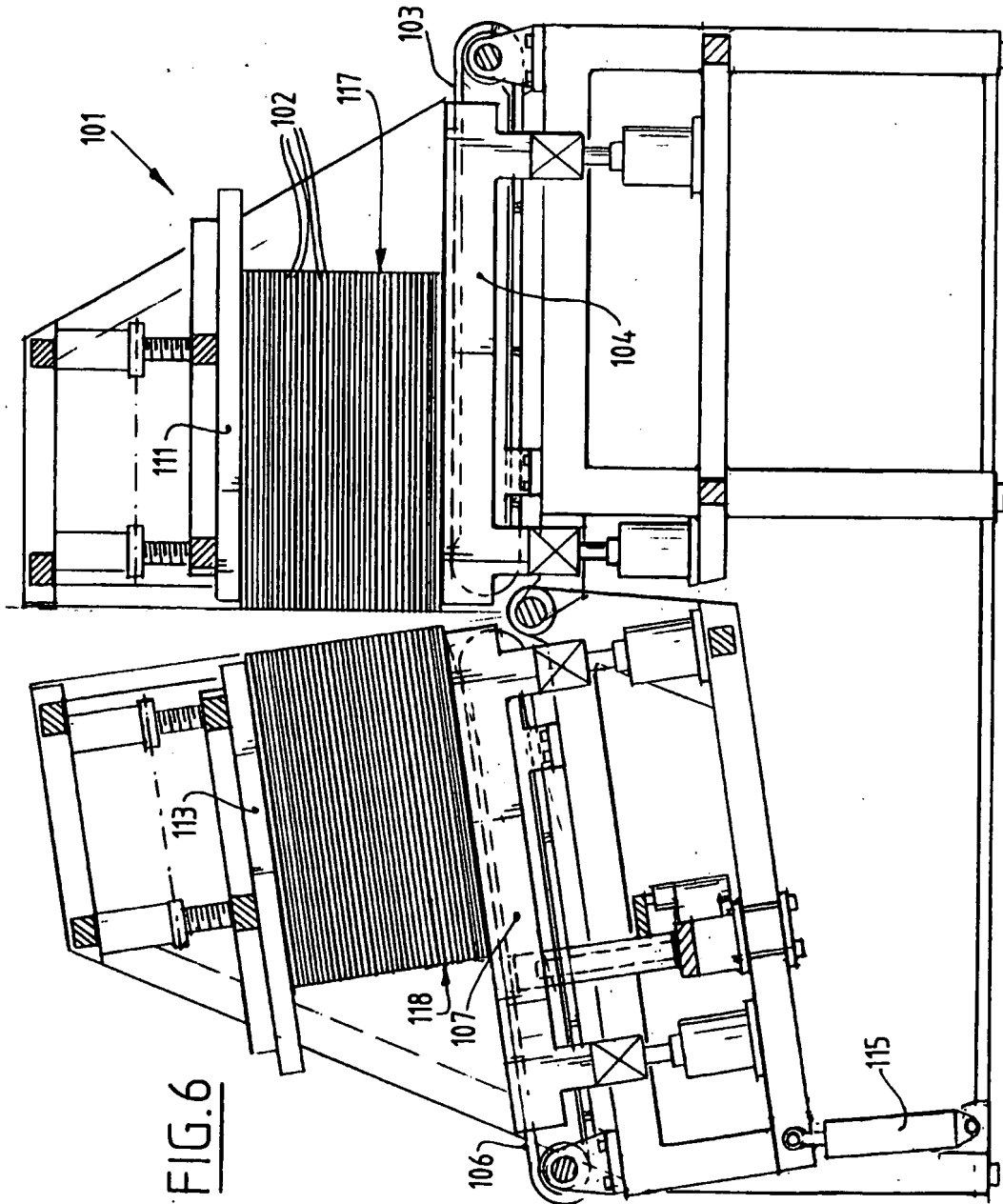
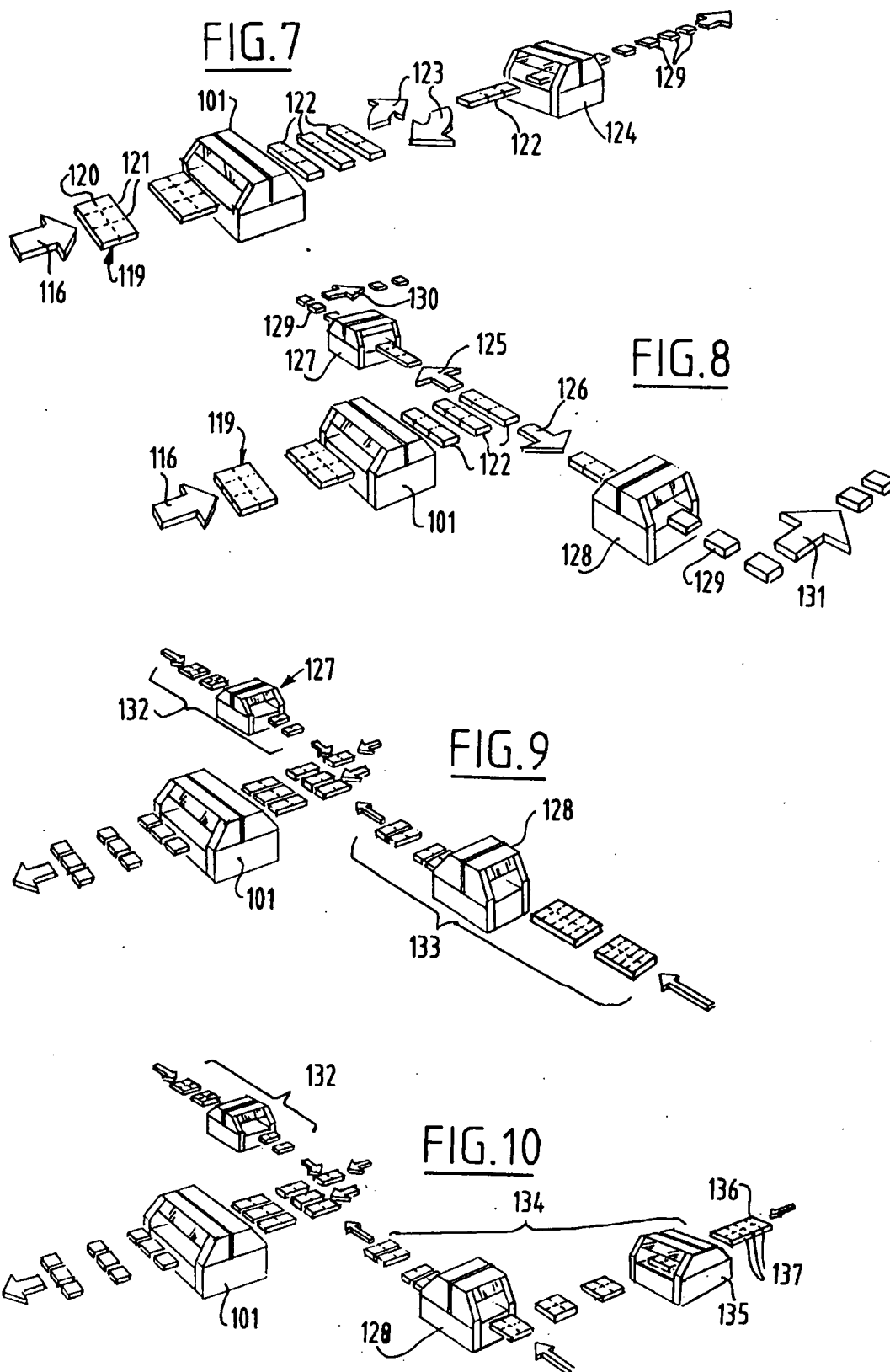


FIG. 3











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## EUROPEAN SEARCH REPORT

Application Number

EP 91 20 2751

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
D,X	EP-A-0 292 067 (R. DE GROOT HOLDING) * column 2, line 1 - column 5, line 5; figure 1 *	1	B26F3/00 B26D9/00
D,Y	---	2,3	
Y	US-A-4 261 254 (NOWACKI) * column 1, line 41 - line 46 * * column 2, line 4 - line 18 * * column 11, line 1 - line 18; figure 5 * ---	2	
Y	EP-A-0 125 830 (UNIROYAL) * page 6, line 19 - page 7, line 24; figures 1,2 *	3	
A	FR-A-2 514 296 (LUCAS) * page 1, line 1 - line 5 * * page 2, line 1 - line 16 * * page 3, line 9 - line 26; figures 1,4 * -----	1	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			B26F B26D B31B
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 15 JUNE 1992	Examiner MATZDORF U.
<b>CATEGORY OF CITED DOCUMENTS</b>			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons ..... & : member of the same patent family, corresponding document	

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/ ES02/00406

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 7: B26F3/00, B26D7/06

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7: B26F3/00, B26D7/00, B26D7/06, B26D7/08

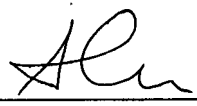
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

ES

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

CIBEPAT, EPODOC, WPI, PAJ

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	FR- 2704798- A1 ( Midoux, Jean Louis ) 10.11.1994,	1,2
A	the whole document	3-5
A	US- 5927582- A ( Duecker ) 27.07.1999, column 2, line 53 -	1-6
	column 5, line 5; drawings	
A	EP- 292067- A1 ( R. de Groot Holding Laag-Zuthem ) 23.11.1988,	2-4
	the whole document	
A	FR- 2514296- A1 ( Lucas, R ) 15.04.1983, abstract; drawings	2-4
<div style="display: flex; justify-content: space-between;"><div> EX. Signature</div><div>6/7/07 Date considered</div></div>		

☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

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31 October 2002 (31.10.02)

Name and mailing address of the ISA/

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